

March 5, 2004

Ms. Toni Hemerka, Borough Manager  
Borough of Bally  
P.O. Box 217  
Bally, PA 19503

Re: Review of Proposed [REDACTED] Farm Well Site

Dear Ms. Hemerka:

In accordance with your request and that of the Borough's Engineer, Mr. Greg Unger, P.E., of Systems Design Engineering, Inc. (SDEI), Pepper Geotechnical Corporation (PGC) has reviewed the suitability of the *Community Public Water Supply* well site proposed on the [REDACTED] Farm to the northeast of Bally Borough. This well site has been proposed by ARCADIS, on behalf of American Household, Inc., as a replacement supply well for Bally Municipal Well #3. As a result of our review, PGC has concerns about the suitability of the selected site, based on: (1) the potential impact that a new high-capacity pumping well at this site could have on the extent of VOC plume at the Bally Ground Water Contamination Site, and (2) the potential for localized contamination problems at the well site.

#### **SITE GEOLOGIC SETTING**

The Bally Ground Water Contamination Site, Bally Borough's two existing municipal wells (#3 – active with treatment; & #1 – inactive), and the proposed [REDACTED] Farm well site fall at the northwest margin of the Newark Triassic Basin. Earlier published geologic mapping (Longwill & Wood, 1965) placed this area just outside of the Newark Basin, although it is clear from compilation of boring logs for the Bally Ground Water Contamination Site and other well records, such as the driller's log for Bally Well #3, that this area is within the sedimentary red beds of the Newark Basin.

The predominant bedrock unit in the site area is the Brunswick Formation, which consists of red shales, siltstones and mudstones. There are also irregular "tongue-shaped" Fanglomerate deposits in this area which "are mostly limestone breccias . . . in a reddish-brown or buff, fine-grained sandy to argillaceous matrix" (Longwill & Wood, 1965). Longwill and Wood (1965) note that:

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These fanglomerates . . . are extensively interbedded with typical shale and siltstone of the Brunswick. The beds of limestone breccia grade along strike into reddish-brown sandstone and then into reddish-brown shale.

Much of the Bally Ground Water Contamination Site falls within one of these Fanglomerate tongues while the [REDACTED]-Farm well site falls within another tongue of Fanglomerate [REDACTED]. Well #3 falls in more typical Brunswick Formation rocks, as the driller logged "red rock" and shale (probably red siltstone and shale) at this well.

The general strike of bedding in the Brunswick Formation is to the northeast-southwest in this area (Longwill & Wood, 1965), although bedding strike may vary locally, particularly within the fanglomerates.

[REDACTED]

#### **IMPACTS OF LARGE PUMPING WELLS IN THE BRUNSWICK FORMATION**

Cones of depression from large pumping wells in the Brunswick Formation are typically not circular in shape, but are elliptical, with their greatest dimension along bedding strike. This is due to the fact that bedding typically imparts a strongly anisotropic transmissivity or hydraulic conductivity to these rocks, due either to the predominance of bedding plane partings or to the "sandwiching" of more permeable, brittle, well-jointed beds between less permeable, softer, more poorly jointed beds. Longwill and Wood (1965) note this typical response:

Wells located on a line perpendicular to the strike of the beds will generally show much less interference than wells located on a line parallel to strike, because the former generally do not penetrate the same strata, but the latter do.

In PGC's experience in the Newark Basin and the similar Gettysburg Triassic Basin to the southwest, cones of depression in these rocks often extend  $\frac{3}{4}$ th of a mile (3500-4000 ft) along bedding strike from large capacity pumping wells. The Delaware River Basin Commission (DRBC) has also noted cones of depression from large capacity pumping wells in the Brunswick Formation which are elongate along strike for distances of  $\frac{3}{4}$ th of a mile (personal communication, Anthony Bonasera, Hydrogeologist, DRBC). Consistent with this widely observed pattern, Longwill and Wood (1965) present the results of pumping tests in the Brunswick Formation in Montgomery and Berks Counties which show extensive drawdown at considerable distances along strike. In one of these pumping tests at North Wales in Montgomery County, 7.4 ft of drawdown was recorded at a distance of 1700 ft along strike from a well pumping at 180

gpm during a 101-hr test.

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Longwill and Wood (1965) note certain instances where drawdown did not propagate along strike to great distances, although these are clearly exceptions, not the general case.

## **PUMPING TESTS AT BALLY GROUND WATER CONTAMINATION SITE**

As part of the ground water investigation of the Bally Ground Water Contamination Site, Civil & Environmental Consultants, Inc. (CEC, 1992) interpreted pumping test data from Bally Municipal Wells #1 and #3 and presented plots (iso-drawdown contours) of the cones of depression generated after pumping periods of less than one day. The cone of depression from Bally Well #3 in this test was relatively equant in shape, while the cone of depression from pumping Well #1 (CEC, 1992, Figure 3-4) was characteristically elongate or elliptical, with greatest dimension parallel to the probable general NE-SW strike of bedrock in the site area. After only approximately 17 hours of pumping Bally Well #1, over 1 ft of drawdown was recorded at Observation Well 87-12D, located approximately 2300 ft to the southwest of Bally Well #1. A copy of the iso-drawdown contour map for the test of Well #1, showing this elongate cone of depression, is attached (CEC, 1992, Figure 3-4). Of these two local detailed pumping tests, one fits the typical pattern for this aquifer of an elliptical cone of depression, while the other does not. This may be a reflection of variable aquifer properties or variable directions of bedding strike with associated variable directions of principal anisotropic transmissivity.

In the pumping tests of Bally Wells #1 and #3, CEC (1992) noted larger drawdowns in deeper observation wells than in nested or clustered shallower wells. This is typical in the Brunswick Formation, as it tends to behave in a confined or semi-confined fashion.

## **POTENTIAL IMPACT FROM A WELL AT THE [REDACTED] FARM ON THE BALLY GROUND WATER CONTAMINATION SITE VOC PLUME**

A test well has been drilled at the [REDACTED] Farm to the northeast of Bally Borough, and ARCADIS is considering a new nearby site for a production well at this tract (personal communication, Mike Bedard, P.E., ARCADIS). The proposed new site would be approximately 3000 ft northeast of Bally Well #1, and approximately 3500 ft to the northeast of the northeastern edge of the

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remaining VOC plume at the Bally Ground Water Contamination Site. The northeastern edge of the remaining VOC plume lies just to the east of Church

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Street based on a March 2003 monitoring episode completed by ARCADIS (2003).

The risk that a high capacity pumping well at the proposed site on the [REDACTED] Farm could affect the northeastern extent of the Bally Ground Water Contamination Site VOC plume appears to be significant based on typical aquifer characteristics and the pumping test of Bally Well #1 presented by CEC (1992). The northeastern edge of the plume is 3500 ft from the proposed [REDACTED]-tract well site, in the probable direction of bedding strike. A high capacity pumping well at the [REDACTED] tract could easily cause drawdown at distances as great as 3500 ft along strike based on the typical performance of this aquifer. While the exact direction of bedding strike is not known in this area, the pumping test of Well #1 (CEC, 1992), which is located between the remaining VOC plume and the Shuhler-tract well site, showed a cone of depression elongate to the NE-SW, parallel to the probable general strike of bedding in the area. After less than 1 day of pumping of Bally Well #1, over 1 ft of drawdown was generated at a distance of 2300 ft from the pumping well. So the idea that measurable drawdown could be generated in this area at a distance of 3500 ft after prolonged pumping (weeks or months) is reasonable.

Successful development of a well on the [REDACTED] tract would hinge on not affecting the extent of the VOC plume. This in turn would depend on encountering aquifer characteristics locally that differ from the typical regional characteristics for this aquifer, and/or on the possibility that bedding strike at the [REDACTED] tract is dramatically different than the probable general NE-SW strike of bedding in the area. While either of these are possible, they are not likely based on what is known at this point, particularly considering the results of the pumping test of Bally Well #1 (CEC, 1992). The likely outcome of a large capacity pumping well at the [REDACTED] Farm site would be an extensive cone of depression elongate to the northeast-southwest, and extending as far as the remaining VOC plume. This suggests that the [REDACTED] Farm well site is a risky one to consider, as it could affect the extent of the remaining VOC plume.

PGC does not recommend development of the [REDACTED] Farm well site for the reasons discussed above. However, if development of the Shuhler-Farm well site proceeds, extensive monitoring would be necessary to define the extent of the cone of depression, given likely anisotropic behavior. ARCADIS (2004) originally proposed just 2 observation wells for a pumping test of the well on this tract, while PaDEP (2004) responded suggesting more extensive monitoring. Intuitively, 8 -10 observation wells, located at various distances and directions

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from the pumping well, and consisting largely of deep wells based on the confined nature of the aquifer, would seem to be appropriate for such a critical

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pumping test. A high number of these wells should be concentrated between the pumping well and the remaining VOC plume. Bally Well #1 should certainly be included as one of the observation wells.

### **SPECIFIC PROBLEMS WITH THE [REDACTED] FARM WELL SITE BEYOND THE POTENTIAL IMPACT TO THE VOC PLUME**

The proposed new well site on the [REDACTED] Farm is near a small ephemeral drainageway which drains to the southeast from PA Route 100. The drainageway appears to fall within the proposed Zone I Well-Head-Protection Area (WHPA). Based on discussions with Mr. Greg Unger, P.E., of SDEI, and on field observations during a 3/2/04 site visit, this drainageway receives raw sewage (gray water) from houses along PA Route 100. In addition, oil or other chemicals lost in hypothetical spillage incidents along PA Route 100 could enter this drainageway and in turn enter the Zone I WHPA of the well. Given the high traffic volumes on PA Route 100, including large trucks, such a hypothetical spillage incident is not unrealistic.

Beyond the broad issue of potential impact to the Bally Groundwater Contamination Site VOC plume, the selected well site would again not appear to be that favorable for these site-specific reasons.

### **RECOMMENDATIONS**

PGC does not recommend development of the [REDACTED] Farm well site due to: (1) the potential that it could affect the extent of the remaining Bally Ground Water Contamination Site VOC plume based on what is known about the site area hydrogeology at this point, and (2) the possibility of localized contamination at the well site. If, however, development of the well proceeds, the monitoring network for the pumping test of the well should be quite extensive so that the impacts of pumping of the well can readily be determined.

Ideally, a replacement supply well for Bally Well #3 should be developed at a more favorable site located at a substantially greater distance from the remaining VOC plume at the Bally Groundwater Contamination Site.

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I hope the scope of this review was consistent with your request. Please call if you have any questions.

Sincerely,

Peffer Geotechnical Corporation

Jeff Peffer, P.G., P.E., President

attachments: (1) Figure 3-4 excerpted from CEC, 1992  
(2) references

cc: Greg Unger, P.E., SDEI

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## REFERENCES

Longwill, S.M., and C.R. Wood, 1965, *Ground-water Resources of the Brunswick Formation in Montgomery and Berks Counties, Pennsylvania*, Ground Water Report W22, Pennsylvania Geologic Survey, 4<sup>th</sup> Series, Harrisburg, PA.

Civil and Environmental Consultants, Inc. (CEC), 1992, Pre-Design Work Plan, Bally Groundwater Contamination Site, Bally, Pennsylvania, consultant's report prepared for Sunbeam-Oster Company, Inc., Pittsburgh, PA, dated May 14, 1992 with revision dates of October 23, 1992 and December 15, 1992.

ARCADIS, 2003, Groundwater Monitoring Report, March 2003 Groundwater Sampling Event, Bally Groundwater Contamination Site, Bally, Pennsylvania; letter report submitted to Mitch Cron, Remedial Project Manager, US EPA Region III, dated June 3, 2003 signed by Michael F. Bedard, P.E., Project Manager, and Frank Lenzo, P.E., Project Director; with numerous attachments.

ARCADIS, 2004, Letter dated February 20, 2004, from Michael Bedard, P.E., and Peter Milionis, P.G. to H. Thomas Fridirici, P.G., of PaDEP SCRO WSM PGM, presenting the "Aquifer Pumping Test Plan" for the well at the Shuhler Farm.

PADEP, 2004, Letter dated February 23, 2004, from H. Thomas Fridirici, P.G., of PADEP SCRO WSM PGM to Mike Bedard, P.E. of ARCADIS G&M, Inc., responding to the proposed pumping test plan for the well at the Shuhler Farm.

Bedard, M., with ARCADIS, Personal Communication during 2/2/04 site visit concerning the location of the Shuhler-Farm Well Site

Bonasera, A., with DRBC, Personal Communication on 2/4/04 concerning extents of cones of depression in the Brunswick Formation.